A STUDY ON CLINICORADIOLOGICAL OUTCOME OF POSTERIOR AND POSTEROLATERAL DECOMPRESSION, STABILISATION WITH PEDICLE SCREWS AND FUSION FOR TUBERCULOSIS OF DORSAL AND LUMBAR SPINE

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CERTIFICATE

This is to certify that this dissertation entitled "**A STUDY ON CLINICORADIOLOGICAL OUTCOME OF POSTERIOR AND POSTEROLATERAL DECOMPRESSION,STABILISATION WITH PEDICLE SCREWS AND FUSION FOR TUBERCULOSIS OF DORSAL AND LUMBAR SPINE**" is the bonafide work done by Dr.D.SOUNDARRAJAN, under my direct guidance and supervision in the Department of Orthopaedic Surgery, Madurai Medical College, Madurai-20.

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DECLARATION

I, **Dr.D.SOUNDARRAJAN**, solemnly declare that the dissertation titled "**A STUDY ON CLINICORADIOLOGICAL OUTCOME OF POSTERIOR AND POSTEROLATERAL DECOMPRESSION, STABILISATION WITH PEDICLE SCREWS AND FUSION FOR TUBERCULOSIS OF DORSAL AND LUMBAR SPINE",** has been prepared by me. This is submitted to **"The Tamil Nadu Dr. M.G.R. Medical University, Chennai,** in partial fulfillment of the regulations for the award of M S degree branch II Orthopaedics.

Place: Madurai **Dr.D.SOUNDARRAJAN**

Date :

CONTENTS

INTRODUCTION

Tuberculosis is ubiquitous in distribution.Globally,nearly 30 million people suffer from tuberculosis. 3 million deaths occur due to tuberculosis per year.India has burden of 6 million cases. Recent increase in the incidence is due to concomitant tuberculosis with HIV infection and drug resistance.Of these 1-3% constitutes skeletal system involvement. Spinal tuberculosis(50%) is the most common form of skeletal tuberculosis.[1]

The evolution of treatment of tuberculosis of spine have passed through different phases of development from Pre-antitubercular era through Post-antitubercular era and from Radical surgery through Middle path regimn.[1]

Traditionally, the anterior approach is the gold standard approach because vertebral bodies and disc spaces are most commonly affected, and the anterior approach allows direct access to the diseased vertebral bodies for debridement and abscess drainage,allows wide decompression and reconstruction of the defect.[2,3]

In the thoracic and lumbar region, morbidity and complications associated with anterior surgery (Thoracotomy, Retroperitoneal) are very significant. Anterior instrumentation to provide bone stability may be tenuous because the concomitant osteoporosis associated with infection renders the vertebrae structurally weak, prevent adequate fixation and the construct is biomechanically less stable.[4,5] The approach to the upper thoracic spine is difficult and there is a need for thoracic surgeon. The lung may be scarred or adherent to the underlying pleura which precludes the anterior approach.

A combined anterior debridement and posterior instrumentation helps to overcome stability related drawbacks of anterior approach alone.[6,7] However, it entails two surgeries (single event or staged) with additional morbidity and is indicated for patients with significant deformity.

In posterior or posterolateral approaches anterior and lateral column can be reached through extra pleural approach. Posterior approach provides excellent exposure for circumferential spinal cord decompression, allows multiple level posterior instrumentation above and below the level of pathology,more stable construct ,less morbid surgery,allows earlier rehabilitation and is a familiar approach.[2,8]

In this study we clinicoradiologically evaluated the outcome of posterior and posterolateral decompression, stabilisation with pedicle screws and fusion for tuberculosis of dorsal and lumbar spine.

AIM OF THE STUDY

The aim of this prospective study is to analyse the clinicoradiological outcome of posterior and posterolateral decompression, stabilisation with pedicle screws and fusion for tuberculosis of dorsal and lumbar spine done in our institution from July 2010 to June 2012.

REVIEW OF LITERATURE

ANATOMY

A typical vertebra has a ventral body and a dorsal vertebral (neural) arch and they constitute spinal canal, which is occupied by the spinal cord, meninges and their vessels. On each side the vertebral arch has a vertically narrower ventral part, the pedicle, and a broader lamina dorsally. Paired transverse, superior and inferior articular processes(zygapophyseal or facet joints) project from their junctions. There is a median dorsal spinous process.[9]

Pedicles are short, thick, rounded dorsal projections from the superior part of the body at the junction of its lateral and dorsal surfaces.

The vertebra is made up of cancellous bone containing red marrow and reticuloendothelial deposits. The tuberculous infection start more often close to the epiphyseal plates.[1]The apophyseal or facet joints has capsule which is loose to permit sliding movement between the contiguous facets.A true tubercular synovitis may occur in these apophyseal joints,in suboccipital or in the atlantoaxial joints.

The fibrocartilaginous intervertebral disc lie between the bodies of the vertebra.Each disc has a central gelatinous material, nucleus pulposus, which develops from notochord and it is surrounded by annular fibosus.They function chiefly as fluctuant shock absorbers. The disc is avascular in adults and the nutrition is dependent upon the diffusion of fluid from the adjacent vertebral bodies.

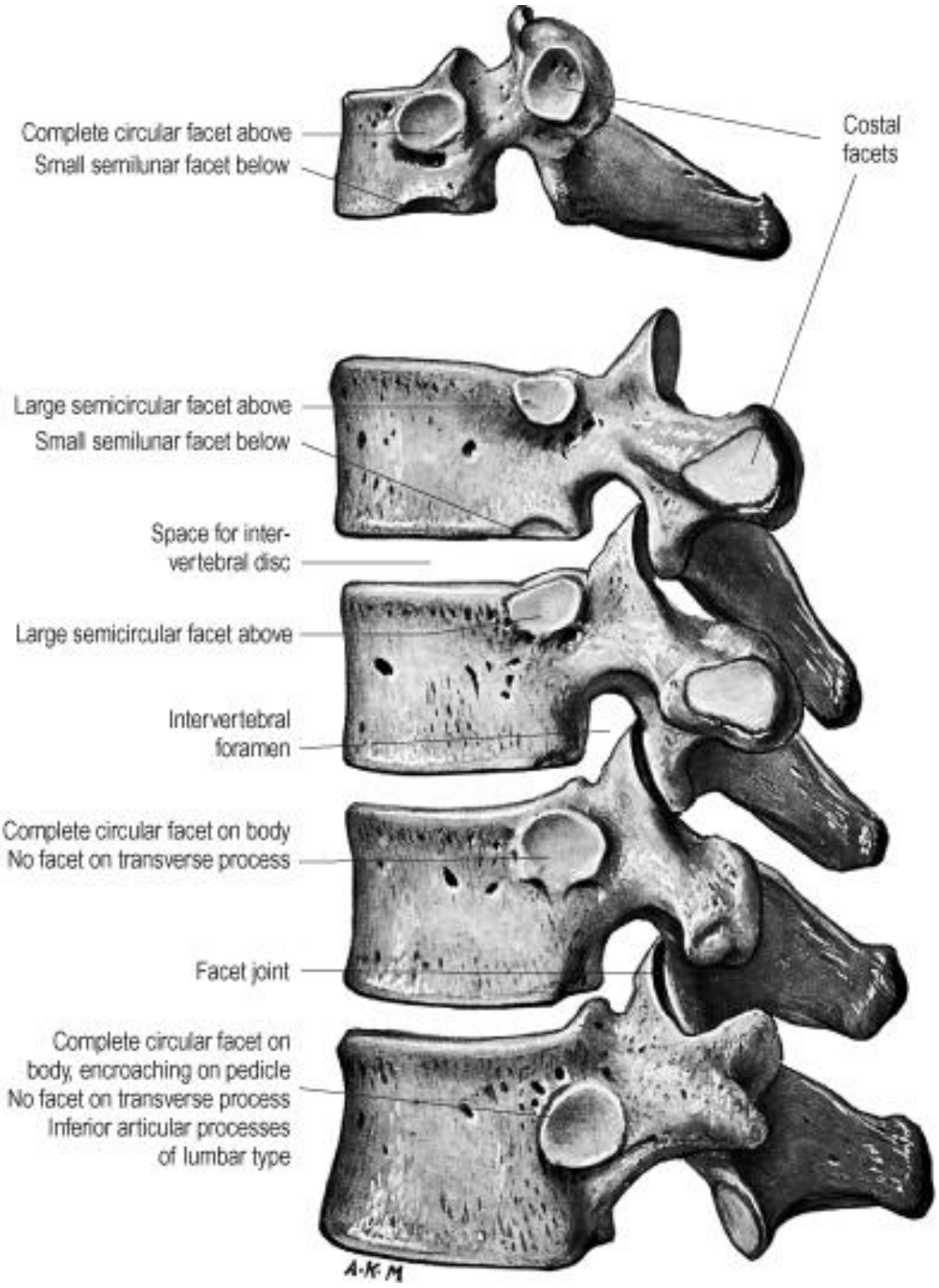


Fig 1.Thoracic vertebra[9]

Embryology:

Each vertebra is formed from the cranial half of one bilateral pair of sclerotomes and the caudal half of the next pair of sclerotomes. Hence the blood supply of the vertebra follows this embryological pattern, branches from each segmental intercostal artery or lumbar artery supplying adjacent halves of the two vertebra, the lower half of the one above and the upper half of the one below and the intervening disc region. Inside the vertebral bodies the arterioles terminate as tortuous loops under the epiphyseal end plates where they lack anastamosis with each other and behave functionally as endarteries (Somerville and Wilkinson,1965).

Arterial supply:

On each side, the main trunk of the Posterior intercostal or lumbar artery passes around the vertebral body, giving off primary periosteal and equatorial branches to the body, and then a major dorsal branch. The dorsal branch gives off a spinal branch which enters the intervertebral foramen.As they enter the vertebral canal the spinal arteries divide into postcentral, prelaminar and radicular branches. The postcentral branch is the main nutrient arteries to the vertebral bodies and to the periphery of the intervertebral discs.

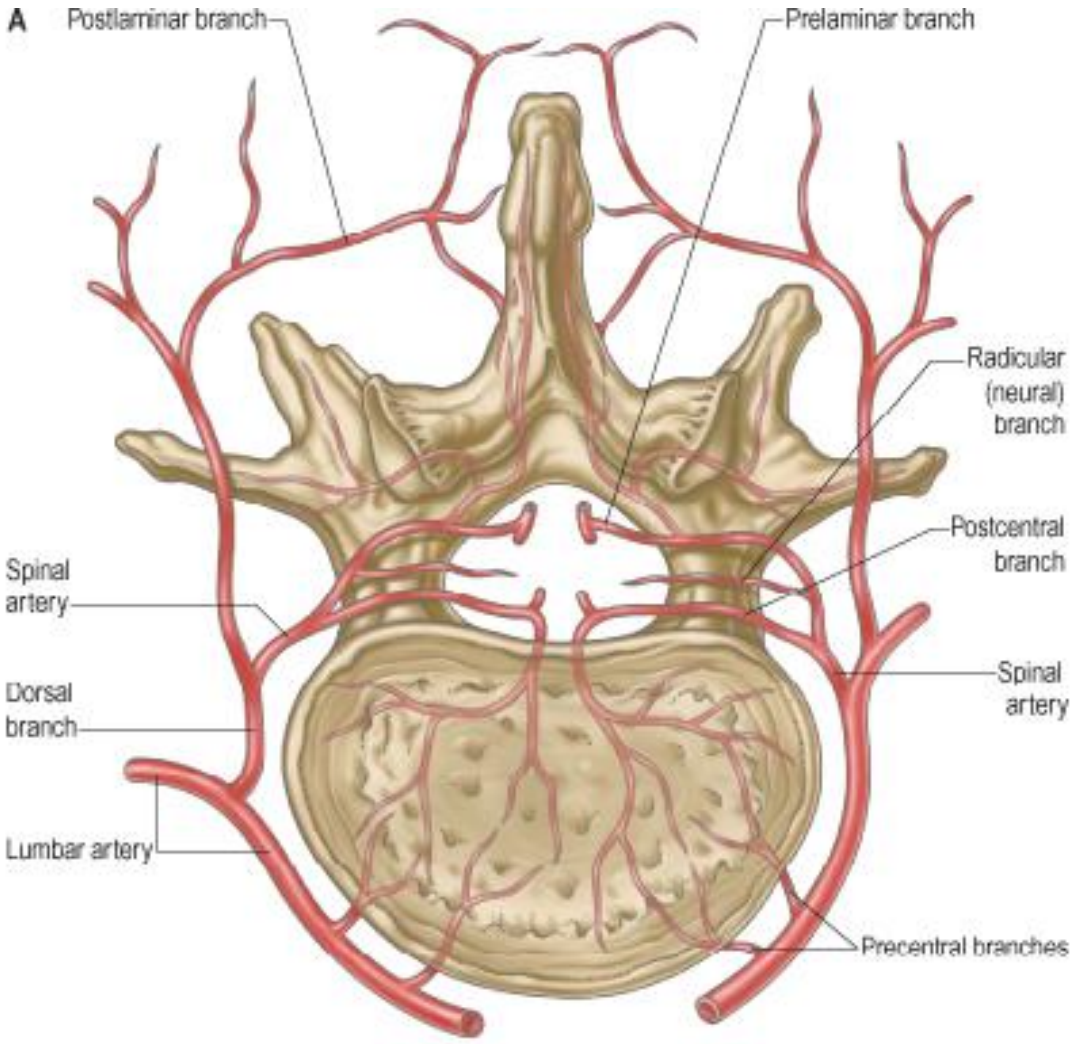


Fig 2.Blood supply of a vertebra[9]

Venous drainage:

The external venous plexus and internal venous plexus form anastamotic columns along the entire vertebral column.They are devoid of the valves.These venous plexus drain into the intervertebral veins.

The external vertebral venous plexuses receive tributaries from vertebral bodies. The internal vertebral venous plexuses receive tributaries from the bones of the vertebral column and spinal cord.The basivertebral veins emerge from the posterior foramina of the vertebral bodies. They are large and tortuous channels in bone.[9]

The intervertebral veins accompany the spinal nerves through intervertebral foramina, draining the spinal cord and internal and external vertebral plexuses.The intervertebral veins drain into the lumbar, posterior intercostal, and lateral sacral veins.The basivertebral veins are valveless and their blood flow can be reversed and constitute Batson venous plexus.Retrograde flow of blood from the pelvic venous plexus to the perivertebral venous plexus may be responsible for the spread of infection from the diseased organs to the vertebral column.

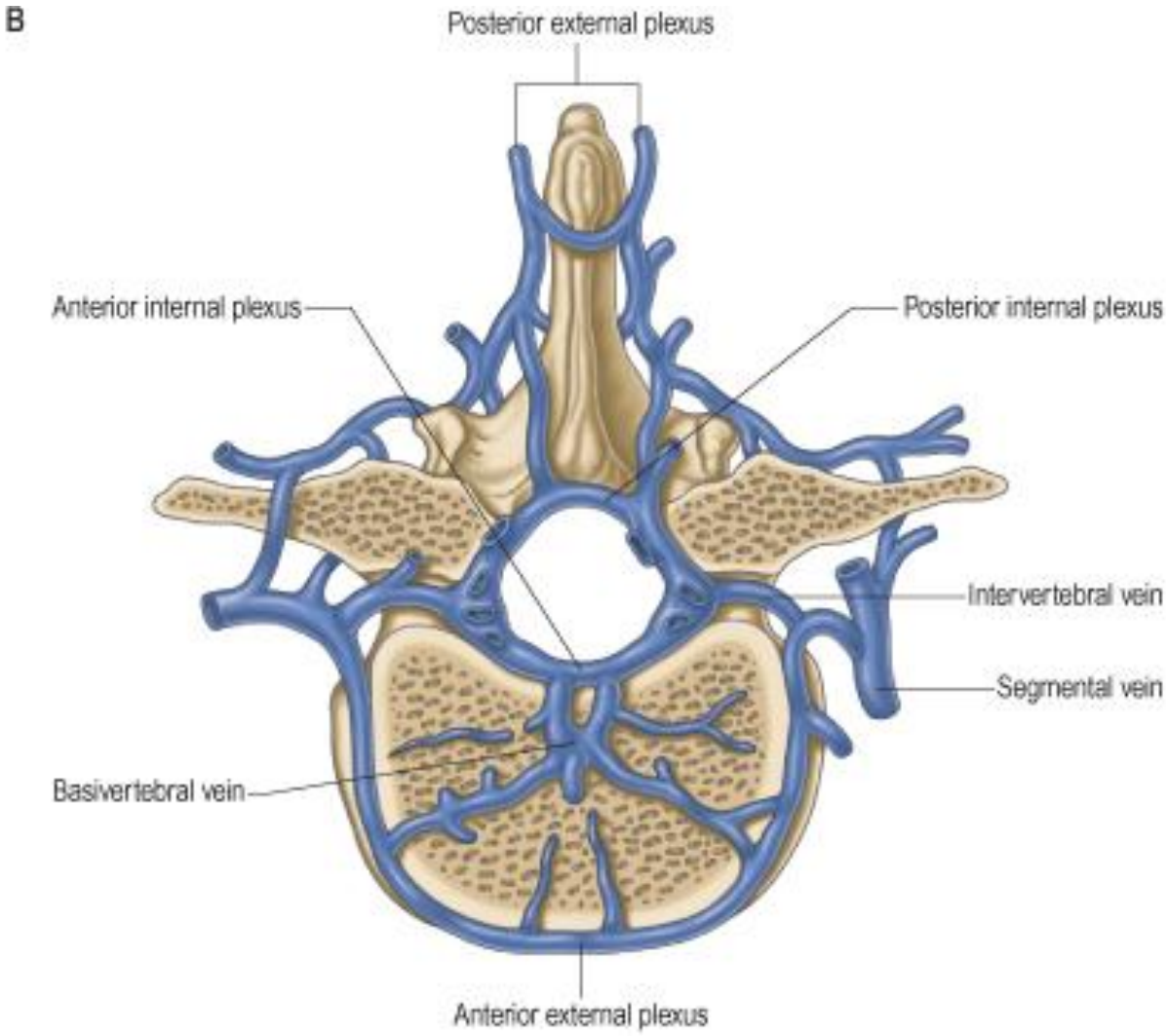


Fig 3.Venous drainage of a vertebra[9]

Lymphatic drainage:

The cisterna chyli is located near the right side of the aorta and behind the right diaphragmatic crus at the surface of L2 (variably, T12-L2). This contiguous site explains the spread of infection to the adjacent vertebral bodies(Hodgson et al.1969).It is formed by right and left lumbar trunks, the lowest intercostal vessels and the intestinal trunk.It is a dilated pouch which ascends as thoracic duct.

Factors involved in stability :

The vertebral column is remarkable in that it combines mobility, stability and load-bearing capacity and also protects its contained neural structures, irrespective of its position. Much of the stability of the vertebral column depends on dynamic muscular control. However there are bony and ligamentous 'static' stabilizers. There is considerable variation between segments of the column regarding stability and mobility: the most mobile levels are the least stable. The latter are those in which the ratio of intervertebral disc height to vertebral body height is highest.

Chronic infections of many types (e.g. tuberculosis) may involve the vertebrae and lead to their deformity and collapse, affect their mechanical properties and compromise their neuroprotective function.

The intervertebral discs, by elastic deformability, permit tilting and axial rotation between vertebral bodies, and also help to reduce vertical accelerations of the head. The main shock-absorbing mechanism of the column stems from the spinal curves, which increase and decrease slightly during locomotion against the restraining tension of the trunk muscles. It is the elastic strain energy in the stretched tendons of the muscle which actually does the shock absorbing.

All ligaments of the column, as well as the facet joint capsules, are important in the maintenance of stability. The anterior longitudinal ligament is very strong, and resists translational displacement (shear) of the vertebrae as well as extension. All the ligaments of the posterior complex resist flexion and rotation, and their integrity determines the range of movements allowed.

Movements are both determined and constrained by the shape and orientation of the facet joints, whose articular surfaces stabilize the column primarily by resisting horizontal gliding (shear) movements and axial rotation.

The whole vertebral column is stabilized by the 'guy-rope' or staying effect of the long muscles which attach it to the girdles, the head and the appendicular skeleton, especially erector spinae, which controls global posture and movement. The small and deep muscles of the back are best able to resist shear movements between vertebrae because only they have sufficient angulation to the

long axis of the vertebral column to do this effectively. These deep muscles can also fine-tune intervertebral movements.

PATHOLOGY

Tuberculous osteomyelitis always arise secondary to a primary foci.The primary foci may be present in the lungs,lymph nodes or gastrointestinal tract. Following bacteremia, the organisms reach the spine through the Batson venous plexus, hematogenous spread or lymphatic drainage.[10]

Types:

Depending upon the focus of tuberculous infection in the vertebra,they can be classified into five types:

1.Paradiscal(commonest),

2.Central,

3.Anterior,

4.Appendecial and

5.Synovial.

The predilection for spinal disease is due to the rich vascularisation of vertebra. The Paradiscal type is the most common type.This is due to the embryological development. Each vertebra develops from Sclerotome which lies on either side of Notochord.Lower half of one vertebra and the upper half of the

one below it with intervening disc develops from each pair of sclerotome and they have common blood supply.[9]

They are disc sparing end plate lesions which may progress further to form the classical spondylodiscitis. This further leads to destruction of the body and the intervertebral disc causing collapse of the body according to the biomechanical forces acting along the vertebral column, leading to local kyphosis in the dorsal region.Healing takes place by bony fusion leading to deformity and if the deformity is severe, it leads to stretching of the spinal cord over the deformity, which in turns leads to late onset neurology.[11]

Tuberculosis of the lumbar region differ considerably from the dorsolumbar lesions. Because of the telescoping type of collapse and lumbar lordosis,the kyphosis usually is minimal and the deformity is expressed as foreshortening of the trunk rather than as kyphosis.

Central type lesions are defined by the involvement of only one vertebral body without involvement of adjacent disc or body which progresses with complete collapse of the body with gibbus deformity leading to concertina type of collapse or vertebra plana. These lesions are associated with spread through Batson venous plexus.[12]

Anterior or the periosteal type affects the anterior part of the vertebral body. This is due the extension of the cold abscess beneath the anterior longitudinal ligament. “Scalloping effect” seen in this type is due to periosteal stripping and aortic pulsation.

Appendicular type represents isolated involvement of the spinous process,lamina,facets and the pedicles.the mode of infection is through the hematogenous spread.These lesions if present in isolation donot cause any deformity on healing.Destruction of facets and the pedicles leads to instability.

Synovial type is the true tubercular arthritis and is seen in the atlantoaxial and atlantooccipital joints.[12]

Cold abscess:

It is defined as abscess without usual signs of inflammation (eg : dolor, rubor, calor). Cold abscess results from collection of pus & tubercular debris from diseased vertebra. It is deeply seated, not warm, sterile abscess.

The Contents of the abscess are Serum, WBC, Bacilli, Granulation and Caseous material. They track along the fascial planes or neurovascular bundles and present as paraspinal abscess, prevertebral abscess or epidural abscess.

Tubercle:

Once the tubercle bacilli reach the vertebral bodies,there is a reaction characterized by the accumulation of the polymorphonuclear cells from the reticuloendothelial deposits.these cells are replaced by the monocytes and the macrophages.These cells ingest and phagocytosis the tubercle bacilli.These leads to dispersion of lipids in their cytoplasm leading on to the formation of epitheloid cells.

The epitheloid cells coalesce to form the langerhan cells.These cells are surrounded by the cuff of lymphocytes.They form a nodule which is characteristically called as 'Tubercle'. Caseation necrosis occurs in the center of the tubercle forming 'Soft tubercle' which is characteristic of Tuberculous lesion.[1]

BACTERIOLOGY

Mycobacterium tuberculosis is a slender, straight or slightly curved bacillus, nonmotile, nonencapsulated and does not form spores. It is a obligate aerobe growing most successfully in tissues with high oxygen content, such as lungs.[13] They are slow growing that divides every 18 to 24 hours and is sensitive to heat(pasteurization) and ultraviolet light.

It is hydrophobic with high lipid content in the cellwall. Because the cells are hydrophobic and tend to clump together, they are impermeable to the usual stains, e.g.Gram stain.They are called Acid fast because they resist decolourisation with the acids.It is a facultative intracellular pathogen usually infecting mononuclear phagocytes.

It grows in optimum pH of 6.4-7.0 ,optimum temperature of 37 degrees in aerated medium. The addition of 0.5% glycerol improves the growth.[14]

Immunodeficiency and tuberculosis:

People with AIDS virus(or persons with CD4+ lymphocyte count less than 100/mm^3) are being infected with atypical tuberculous bacilli and many of these strains already show resistence to a large number of antituberculous

drugs.HIV infected persons due to dysfunction of the host immune system,have a very high risk of getting primary tuberculosis, reactivation of the previous tuberculous lesion in the body,and concomitant infection by another strain of tuberculous bacillus by the exogenous route.The incidence of tuberculosis in patients with AIDS is almost 500 times the incidence in the general population.Patients with HIV and tuberculosis are a potential source for the spread of drug resistant strains of tuberculous bacilli to the other members of the society. Prolonged use steroids, methotrexate and immunosuppressive drugs may also lead to immunodeficiency.

CLINICAL FEATURES

Spinal tuberculosis is more common during first three decades of life. As with other forms of the tuberculosis, the frequency of the spinal tuberculosis is related to the socioeconomic factors and the endemic exposure to the infection. The disease equally affect both the sexes.

Spinal tuberculosis most commonly affect the thoracolumbar region followed by the thoracic and the lumbar spine.The predeliction for the thoracolumbar region has been attributed to the close proximity to the cistern chili and the kidneys, more spongy tissue, the biomechanical transition between a fixed thoracic spine and the mobile lumbar spine. Lower thoracic vertebra are the most common area of involvement(40-50%),followed closely by the lumbar spine(35-45%).[15]

Signs and symptoms:

The presentation of the spinal tuberculosis depends upon the stage of disease, the region of the spine affected and the development of complications such as neurologic deficits, abscesses or the sinus tracts. The reported average duration of symptoms at diagnosis is 4 months but can be considerably longer due to nonspecific presentation of chronic back pain in some of the patients.

Constitutional symptoms like malaise, loss of feeling of wellbeing, loss of apetite and weight loss, evening rise of the temperature with occasional night sweats are present. The commonest presenting symptom is progressive local back pain for weeks to months, with or without associated muscle spasm and rigidity.[1]

The back pain in tuberculosis is due to the chronic inflammation, segmental instability, distension due to abscess and pressure on neighboring structures.

Presence of regional muscle spasm could be an indication of instability. In the thoracolumbar region, bilateral muscle spasm leads to prominence of the midline furrow with prominent paraspinal muscles on either side. Patients with unilateral muscle spasm presents with a sciatic list. Patient may need to support their trunk by placing their hands on the knee which is called Tripod sign.

Patient is typically worse during night(night cries) as reduction in muscle spasm unmasks the instability, waking the patient from sleep.[1,4] Compression due to abscesses and free bony fragments can cause radicular pain along the nerve roots. Radiating pain from dorsal roots present as girdle pain or Intercostal neuralgia and from lumbar roots as pain to groin & abdomen.

Cold abscess:

Presence of a cold abscess usually indicates active disease. The cold abscess are well defined, smooth with regular margins and fluctuant. The skin over the abscess are stretched and shiny. The classical features of pyogenic abscess are absent and hence called Cold abscess.

Superficial abscess may slowly weaken the subcutaneous and dermal tissues and burst leaving a discharging sinus. The tubercular pus is white or pale yellow with no specific smell and has a ambient body temperature. The consistency of the pus varies from thin water like rice soup to thick porridge. Occasionally, the lesions may get secondarily infected with other pyogenic organisms and the abscess may present with signs of acute or active infection.

Most deep abscesses, except those which are very small, those within the thorax and anterior ad anterolaterally formed abscesses are clinically palpable. Some posterior compartment abscesses and those from te sacroiliac joints may be difficult to palpate. They may present as a tender fullness elevating the overlying muscles.

The cold abscess slowly dissect the surrounding areolar tissues and spread along the natural tissue planes far away from the primary focus. They track along the muscle planes, perineural, perivascular, subpleural,subperitoneal and natural areolar tissue spaces.[1,12]

Deformity:

Spinal deformities occur as a result of destruction during the active stage of the disease, following surgical debridement and decompression of the tuberculous lesion, or during healing and growth in children.

Depending upon the number of vertebral bodies involved, the patient develops varying magnitudes of kyphosis. Localised kyphosis due to collapse of one vertebral body is called Knuckle deformity.

Kyphosis resulting due to collapse of one or two vertebral bodies is called Gibbus deformity and collapse of more than three vertebral bodies results in Angular kyphosis.[16]

Rajasekaran, who described the "spine at risk signs" has stated that the kyphotic deformity is "dynamic in continuum" and needs surveillance till the entire growth potential is completed.

In childhood spinal tuberculosis, patient who have subluxation of facet joints during active stages of the disease can develop severe spinal deformities during growth. Untreated sever post tubercular kyphotic deformities can result in neurological deficits.

Neurological deficits:

The incidence of neurological involvement in Potts disease is 20-40%. Paraplegia rarely occurs in the tuberculous affection below L1 as the cord terminates at L1 where the spinal cord is capacious and contain only cauda equina. The presentation of patients with neurologic complications varies from subtle gait disturbances to complete deficits with bladder and bowel involvement.

In a typical anterior disease of the vertebral column, the compression starts anterior to the spinal cord by abscess formation. This is manifested clinically as gradual increase in the spasticity. As compression increases, patients start losing motor power gradually. By the time compression is severe enough to cause complete block to the nerve conduction and anterior column, lateral spinothalamic tracts are also affected thus producing some reduction of sensation.

When the compression is further increased, even posterior column is also affected leading to complete loss of sensation and disturbances of sphincters. In long standing compression, the spasticity is replaced by flexor spasms and flaccidity.

Classification:

The neurological deficit associated with spinal tuberculosis is traditionally divided into two types [1] (Griffifth, Seddon and Roaf, 1956).

Group A: Paraplegia of early onset:

It occurs with the active stage of the disease usually within first two years. The extrinsic causes are granulation tissue, abscess, tubercular debris, tuberculous caseous tissue, internal gibbus and pathological subluxation of vertebra. The intrinsic causes are Inflammatory edema and infective thrombosis/endarteritis of spinal vessels.

Group B: Paraplegia of late onset:

It usually occurs after many years and after apparent quiescence of the disease. The extrinsic causes are transverse ridge of bone anterior to the spinal cord producing pressure and constricting scar around dura. The intrinsic causes are inflammatory edema and stretching of spinal cord.

- Based upon degree of motor weakness, **Kumar** [17] classified the tuberculous paraplegia into four grades:

I	The patient does not appreciate weakness but clinician notices clumsiness of gait and signs suggestive of upper motor neuron lesion (plantar extensor and ankle clonus).
II	Patient has motor weakness and signs of upper motor neuron lesion,but has sufficient power that he/she manages to walk(motor power grade 3 or above).
III	Bedridden(severe motor weakness)with signs of paraplegia but sensory loss less than 50%.
IV	Complete motor weakness with loss of sensation more than 50% and/or bladder bowel involvement and/or flaccid paraplegia and/or paraplegia with flexor spasms.

- **Frankel(**1969)[12] has classified the neural deficit in spinal tuberculosis into five grades:

A	Absent motor and sensory function below the segmental level.
B	Sensation present,absent motor function
C	Sensation present,some motor power present below the level of the lesion but not useful to the patient (Grade <3/5)
D	Sensation present,motor function present and patient could walk with or without aids(Grade 3,4/5)
E	Normal motor and sensory function.Abnormal reflexes may be present.

We used frankel grade to assess the degree of neurological deficit in our patients.

LABORATORY DIAGNOSIS

BLOOD INVESTIGATIONS:

Cell counts:

The cell count (Total count and Differential count) is elevated. Lymphocytosis present in differential count.

Erythrocytes sedimentation rate (ESR):

The ESR is elevated generally above 20 mm/hr.It is used to monitor the response to treatment. It generally normalizes within three months of treatment. Failure to normalize after treatment should arouse suspicion regarding primary drug resistance or alternative etiology. Though simple, ESR lacks specificity.[12]

C-Reactive protein (CRP):

C-Reactive protein has been found to be elevated in spinal tuberculosis up to 71 %.It is more specific for infectious and inflammatory lesions.It takes two weeks while Erythrocyte sedimentation rate takes about four weeks to register a change and thus has a more value in monitoring the treatment response.

TUBERCULIN SKIN TEST:[19]

It is considered as a corroborative evidence for tuberculosis. An induration of more than or equal to 10 mm has been considered positive. The role of tuberculin skin test as a diagnostic tool is often circumspect. Also it may be false negative in immunocompromised individuals and in military tuberculosis. At best,it can be considered as a corroborative evidence for tuberculosis; negative evidence of which does not necessarily rule out tuberculosis.

SEROLOGICAL TESTS:

Serological tests using ELISA have tested antibody response to various TB antigens.There is fall of IgM titer and rise of IgG titer following three months of treatment.It is considered as screening test rather than diagnostic tool.[12]

In equivocal cases of spinal infection, serological tests for brucellosis should be carried out in view of striking similarity in the presentation of both diseases. Serological tests for brucellosis are considered positive if the antibody titre is more than 1:80.

TISSUE DIAGNOSIS:

The most conclusive means of reaching diagnosis in spinal tuberculosis is histopathological examination and AFB culture. It is done via transpedicular or posterolateral route with bone biopsy needle such as Jamshidi or Cooke needle.[20] In case of multiple skeletal site involvement, tissue for diagnosis can be retrived from the most easily accessible region.

Smear examination:

The two common staining methods used to identify bacillus are Ziehl-Neelson method and Auramine Rhodamine staining.

Culture:

The most common solid medium is Lowenstein-Jensen, an egg based medium. Positive detection rate with this method in spinal tuberculosis has ranged from 0 to 75%,albeit less in pulmonary tuberculosis in view of its paucibacillary nature. Its major drawback is prolonged time taken for identifying growth. Another method for rapid detection of growth is BACTEC method.[1,12]

Histopathological examination:

Typically, caseating granulomas and epitheloid giant cells characterize tuberculous tissue. Histopathological diagnosis available within 7 to 10 days.It is positive in 62 to 92.5% of cases. Thus,this has a higher percentage of positive diagnosis and also takes a relatively shorter time than culture. Primarily,it helps to ruleout noninfectious etiology such as neoplasm.However, it cannot identify drug resistance unlike a culture test.

MOLECULAR DIAGNOSIS:

PCR and Genotyping have helped in faster diagnosis and differentiating between typical and atypical mycobacteria, as well as identification of drug resisitance. The basic principles of PCR are amplification of the target genes, such as IS986,IS6110 and p34.[12] The PCR technique can be used directly on the tissue sample or can be used secondarily on the cultured growth as well. Tissue PCR has a sensitivity of 60 to 75% and specificity of 94 to 100% in extrapulmonary tuberculosis.

Recently, a rapid type of PCR technique called the multiplex real time PCR has been introduced. The overall sensitivity and specificity of the multiplex PCR were 93.3% and 90% respectively, with an accuracy of 92%.These results

suggest that multiplex real time PCR is far more sensitive than conventional cultures, and this, together with its speed, makes this technique a very valuable investigatory modality.

RADIOLOGY

Xrays:

Anteroposterior and lateral views of the involved part and Chest Xray are required. In the region of thoracic spine paravertebal abscess is visible as a fusiform or globular radiodense shadow called the bird nest appearance. Long standing abscesses may produce concave erosions along the anterior margins making the aneurysmal phenomenon.[1,4]

Paradiscal lesion is the commonest radiological lesion.Its earliest signs are disc space narrowing and indistinct paradiscal borders of the vertebral bodies.

Central type of tuberculous disease is associated with areas of destruction and concertina type of collapse.

Anterior type of tuberculous disease appears as anterior border of vertebral body erosion called scalloped appearance and is more common in children.[1,6]

Appendecial disease involves posterior arches.It can be easily missed by conventional radiography.

CT and MRI:

CT scan helps in determining posterior extension and encroachment of inflammatory disease,bone and disc material.Additionally,it diagnoses the involvement of sacroiliac joints and sacrum and posterior spinal disease.It also helps in CT-guided biopsy.[1,12]

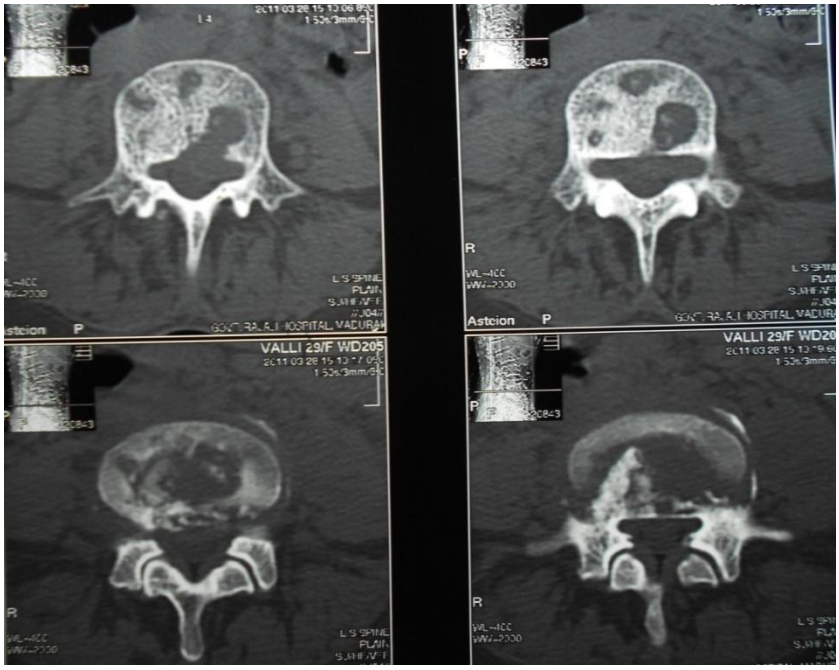


Fig.4 CT of D12-L1 Tuberculosis of spine

MRI is the most sensitive test for early diagnosis of spinal tuberculosis.[1]The lesion appears hypointense and hyperintense respectively in the T1 and T2 weighted images.MRI is superior to CT in showing soft tissue compression,

tuberculous arachanoiditis and extradural and intradural spread of the abscess or granulation tissue.

Fig.5 MRI of D12-L1 Tuberculosis of spine

Ultrasound:

Ultrasound is useful in identifying the shape and extent of the cold abscess.It provides quantity of the abscess and also used for ultrasound guided aspiration.

Bone scan:

Technetium-99m methlene diphosphonate and Gallium-67 isotope scanning are used but neither of them is specific enough for routine use as a diagnostic tool.[21] It may be used to localize the area of involvement. Patients with active disease have an increased uptake, whereas in avascular segments and abscesses it may show decreased uptake.

DIFFERENTIAL DIAGNOSIS

Infections:

Bacterial:

-Pyogenic spondylitis

-Typhoid spine

-Brucella spondylitis

-Syphilitic infections

Mycotic infections:

-Actinomycosis

– Blastomycosis

– Candidiasis

– Cryptococcosis

– Histoplasmosis

Parasitic infections:

-Hydatid disease

Tumorous conditions:

-Multiple myeloma

-Lymphoma

-Secondaries

-Histiocytosis X

Scheuermann's disease

Traumatic conditions

Tuberculosis can be a differential diagnosis for almost every lesion in the spine. Since tubercular and other lesions closely mimic each other, one must be alert not only during the initial assessment but also throughout the duration of treatment.

The plain radiographs and the CT scan may show destruction, loose bony fragments or sequestra, bony encroachment into the spinal canal and soft tissue abscesses. Radioactive scans can show local biological activity. However,biopsy with bacteriological studies and histological confirmation can only give the final verdict.

Pyogenic spinal osteomyelitis starts with acute onset of severe pain, marked muscle spasm and high fever. The clinical course of the disease is usually rapid with severe systemic symptoms. The hasty clinical course and MRI imaging features helps in differentiating from tuberculous infections. An early well localized tubercular disc infection may be diagnosed as disc herniation.

Vertebral compression fractures should raise suspicion for spinal tuberculosis in patients with appropriate risk factors. Primary neoplastic lesions,

like lymphoma and various other metastatic lesions are frequently confused with tubercular destruction. Deterioration of immunity due malignant disease and chemoradiotherapy may play a role in the reactivation of old tuberculosis or acquiring a new infection.

MATERIALS

This study was conducted in our Hospital on 15 patients with Tuberculosis of Dorsal and Lumbar spine from July 2010 to June 2012. All patients were treated with posterior or posterolateral approach and stabilised with Pedicle screw system.

Objectives :

(a) To study the effectiveness of posterior and posterolateral decompression, stabilisation with pedicle screws and fusion for tuberculosis of dorsal and lumbar spine.

(b) To study the improvement in the angle of kyphosis.

(c) To show that posterior surgery allows early mobilisation.

(d) To evaluate that posterior surgery associated with reduced morbidity and mortality.

Selection criteria:

The **Inclusion criteria** is age group of 12 to 70 years of age, mild to moderate amount of cold abscess. no improvement with conservative treatment and worsening of neurological deficit**.** Patients less than 12 years of age,huge cold abscess, severe kyphotic deformity with internal gibbus and patients not fit for anaesthesia are **excluded** from the study.

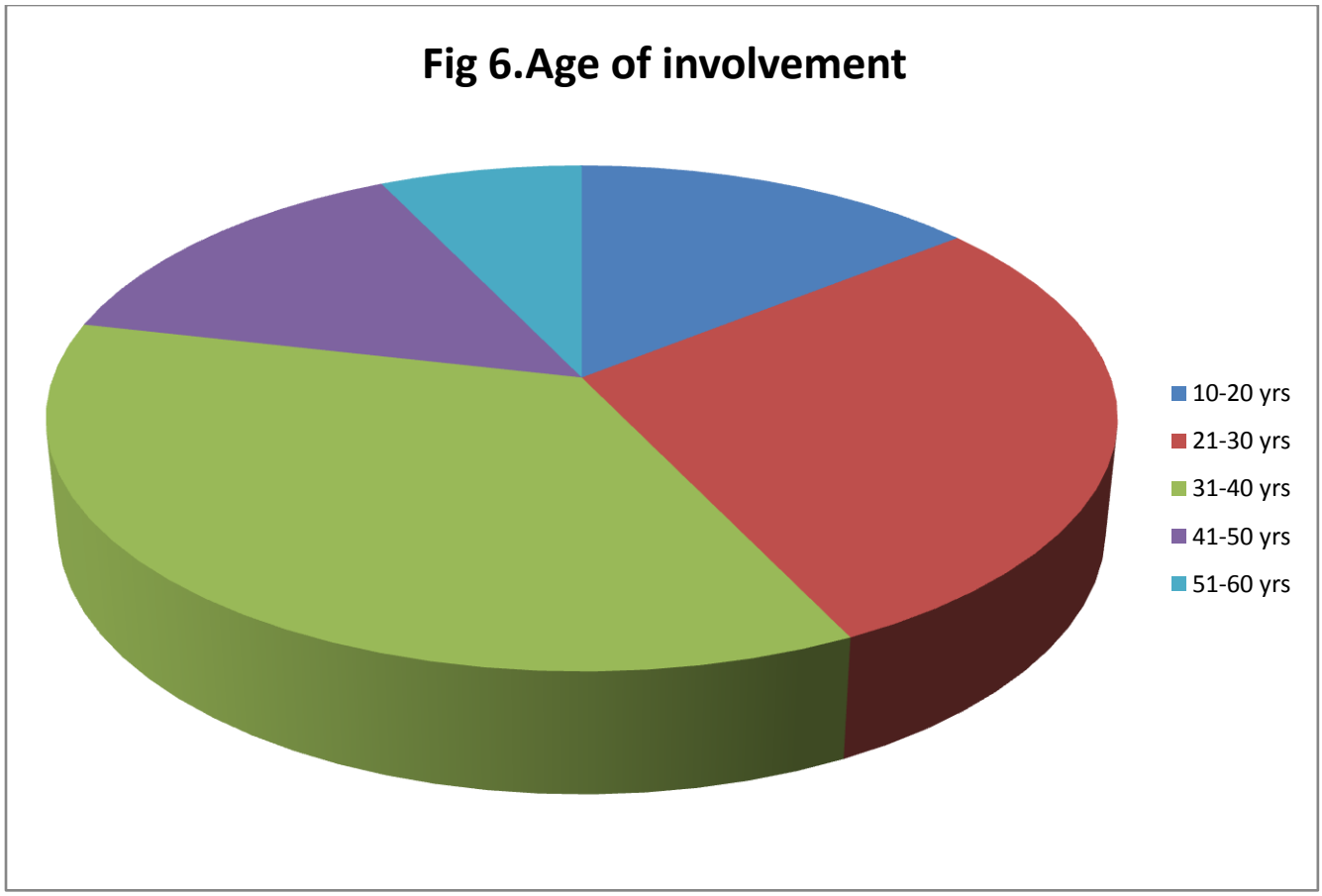
During study age of patient, mode of presentation, Level of the lesion and associated co morbid condition are considered. Anti tuberculous therapy started.

Pre operative planning:

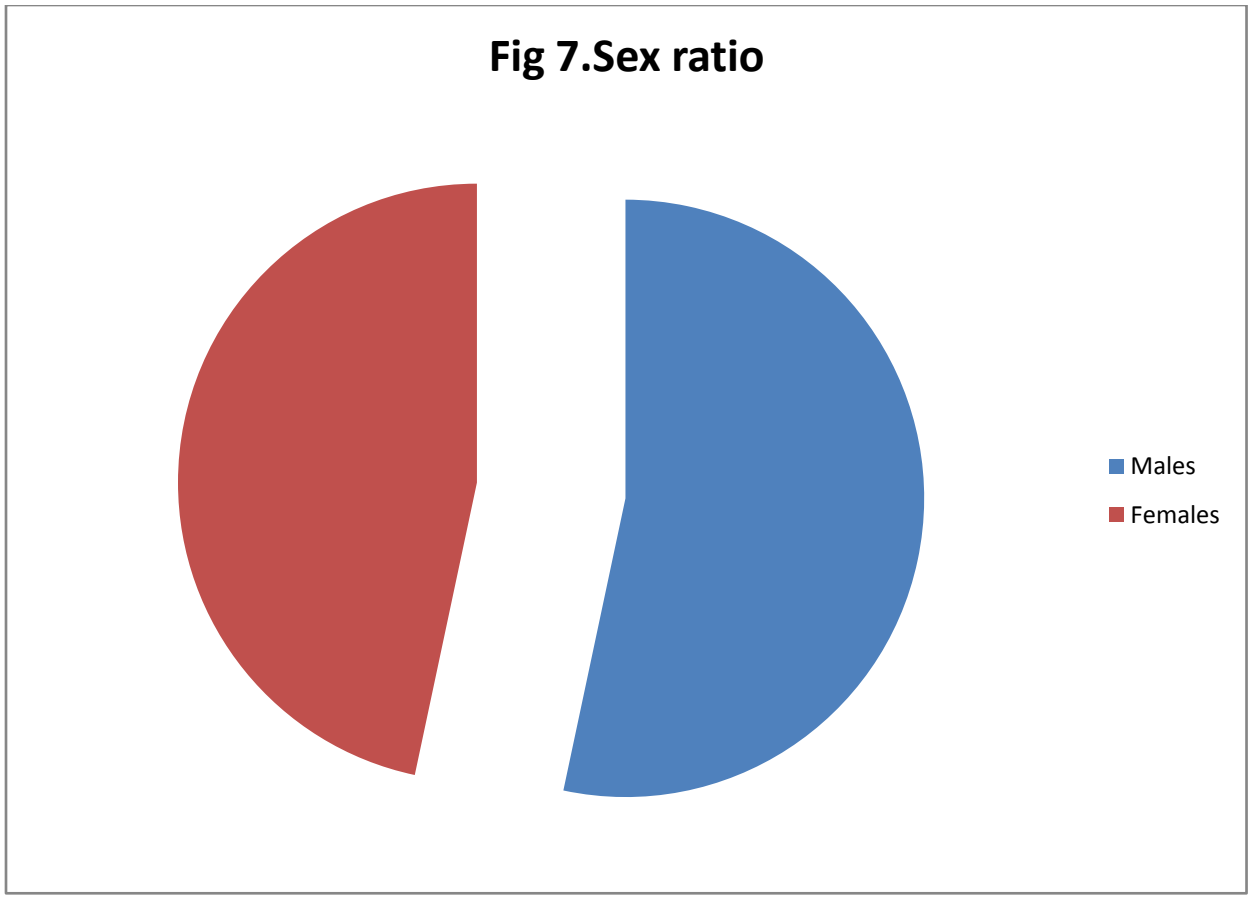
Pain evaluated by Visual analog score.Neurological status documented by Frankel's grade. Radiographic examination includes AP view, Lateral view of the dorsal or lumbar spine, CT scan and MRI.

Per operative evaluation:

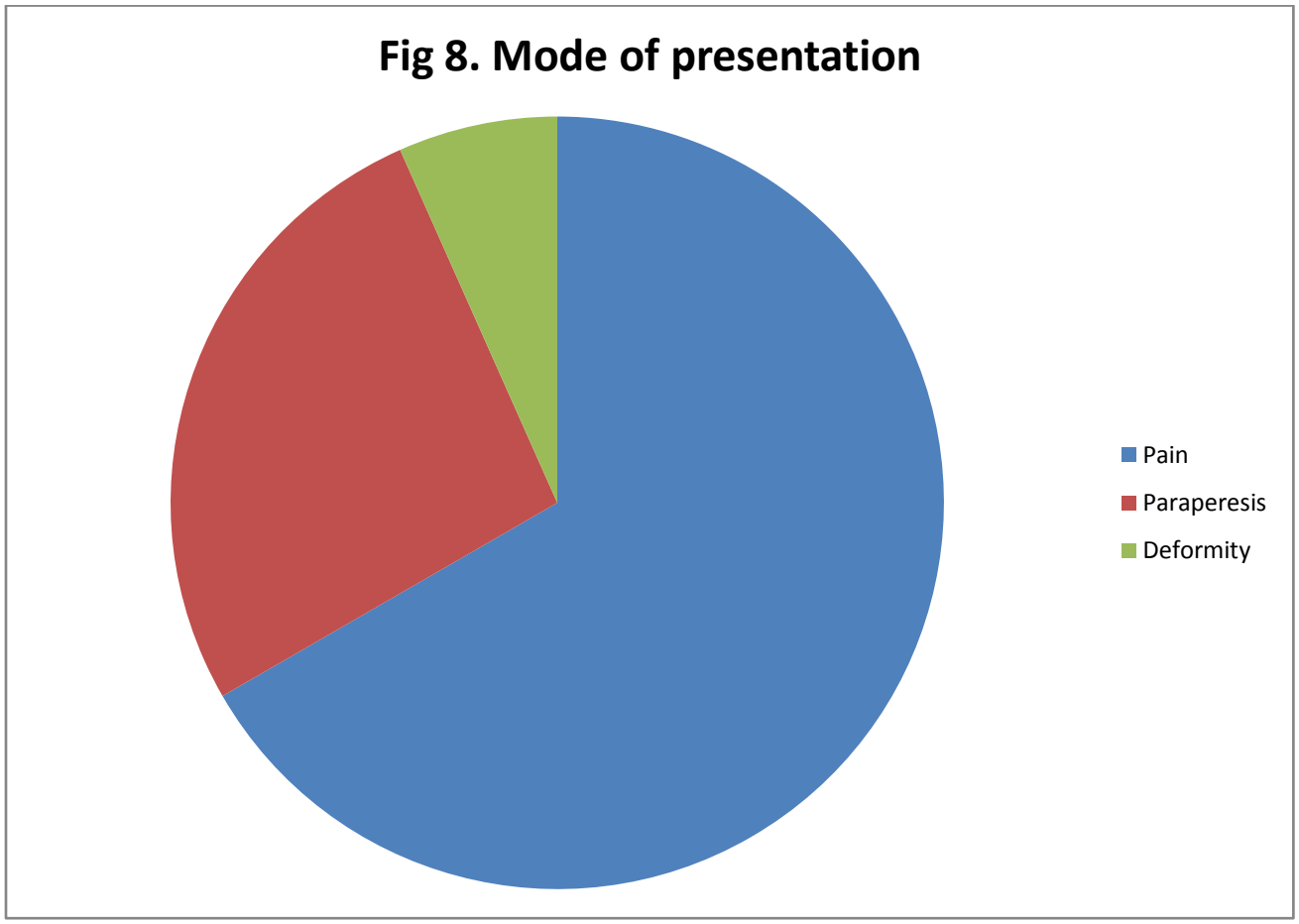
During surgery operative blood loss, operative time are noted.



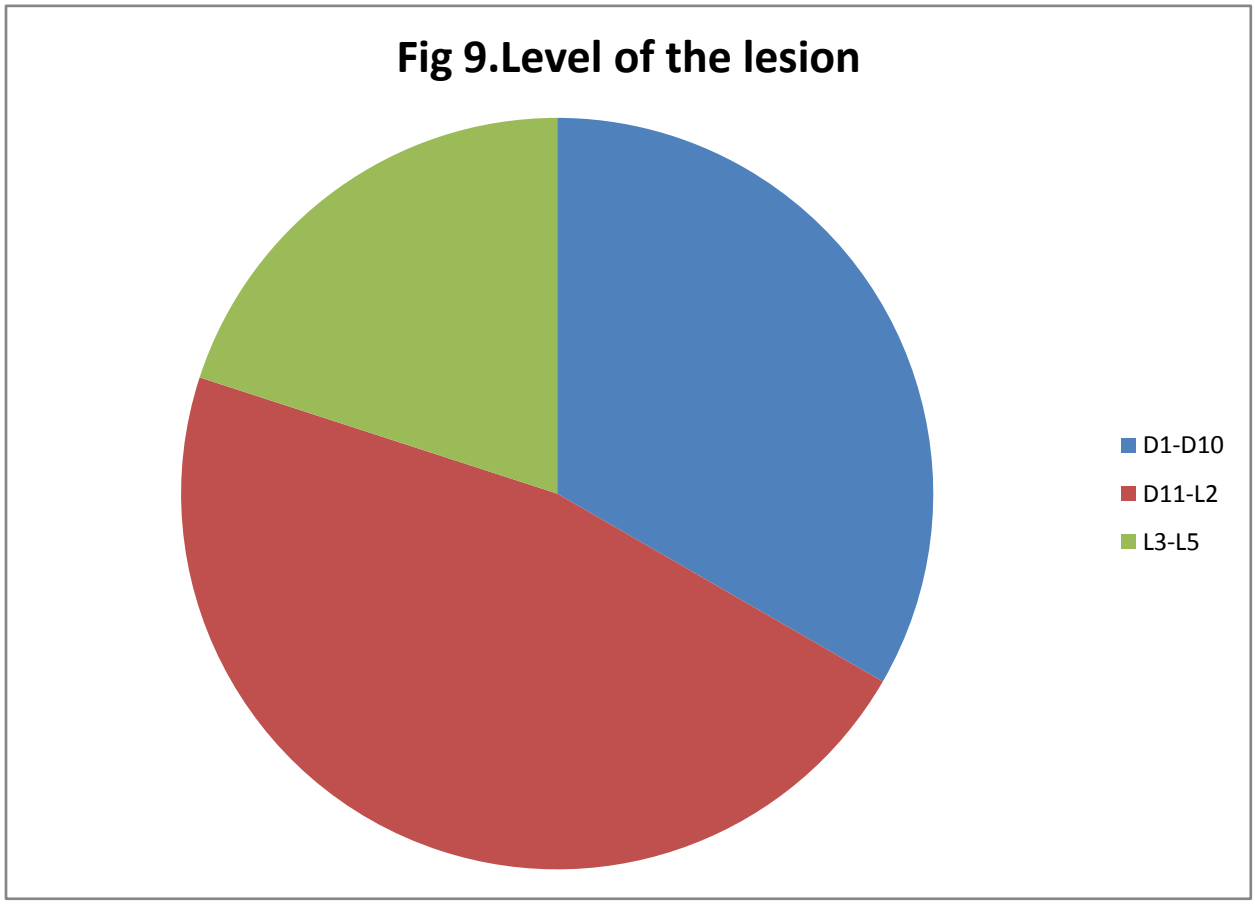
AGE OF INVOLVEMENT	
10-20 yrs	2
21-30 yrs	4
31-40 yrs	5
41-50 yrs	2
51-60 yrs	1
61-70 yrs	1



SEX RATIO	
Males	8
Females	7



MODE OF PRESENTATION	
Pain	10
Paraperesis	4
Deformity	1



LEVEL OF THE LESION	
D1-D10	5
D11-L2	7
L3-L5	3

Choice of implant:

Pedicle screw system.

INSTRUMENTS

METHODS

Anaesthesia:

General anaesthesia.

Position of the Patient:

Prone position. Bolsters are placed longitudinally under the patient's sides to allow the abdomen to be entirely free.Pressure points are carefully padded.

- After preparing and draping the surgical site, Skin and subcutaneous tissue infiltrated with Tumuscent solution.

Incision:

Midline longitudinal incision made over the spinous processes, extending from the spinous process above to the spinous process below the pathologic level. The length of the incision depends on the number of levels to be explored.

Internervous Plane:

The internervous plane lies between the two paraspinal muscles (erector spinae), each of which receives a segmental nerve supply from the posterior primary rami of the lumbar nerves.

Superficial Surgical Dissection:

The incision is deepened through fat and fascia in line with the skin incision until the spinous process itself is reached. Paraspinal muscles detached subperiosteally as one unit from the bone. Self-retaining retractors are used to maintain tension on soft tissues during exposure.

- Among the three techniques for localization of the pedicle namely (1) the intersection technique, (2) the pars interarticularis technique, and (3) the mammillary process technique, we use the intersection technique which is a point between the line from transverse process and lateral aspect of facet joint.
- Once pedicle screws are inserted,temporary stabilisation done with rod on one side.
- Through transpedicular approach, body was approached posteriorly and also through posterolaterally and decompression done for dorsal spine. If

necessary root is sacrificied for better exposure in dorsal spine.Transpedicular and posterior decompression done for lumbar spine.

- Next, the disc space was distracted and the infected end-plate, disc ,soft tissue,necrotic debris and abscess were meticulously debrided.
- Interbody fusion was done with bone graft, voids were filled with graft. Stabilization was done with pedicle screw construct.

Intraoperative Technique

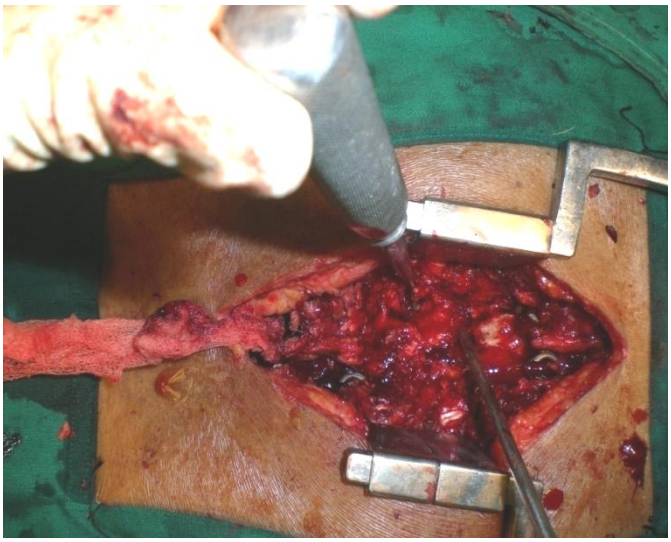


Fig 10.Exposure and Transpedicular decompression

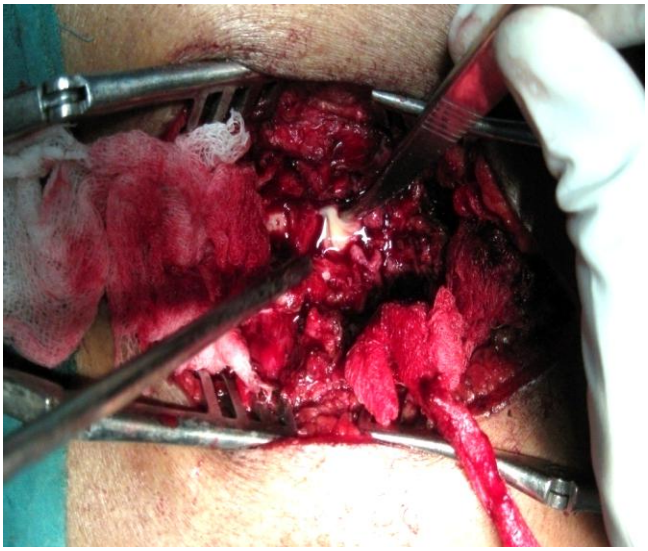


Fig 11.Evacuation of pus and granulation tissue

Fig 12.Harvesting graft from posterior iliac crest

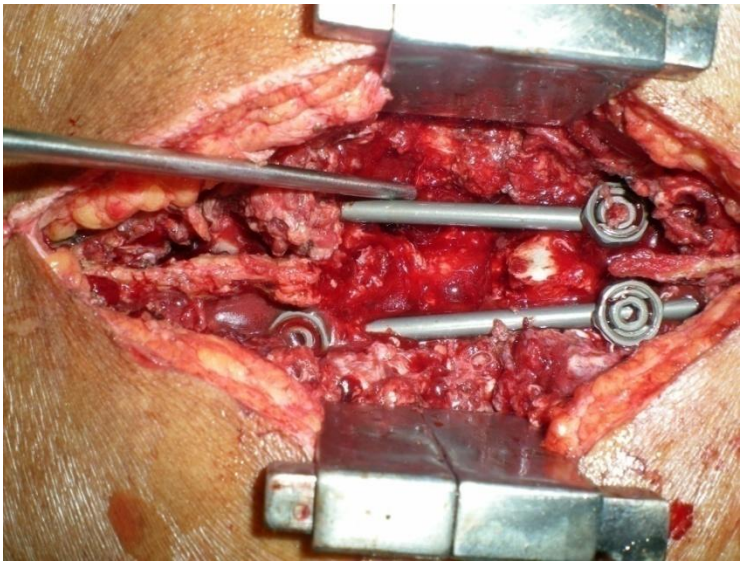


Fig 13.Stabilisation with pedicle screws

Post-op protocol :

- Early mobilisation from the bed with hyperextension brace..
- Muscle strenthening exercises as soon as the pain subsides.
- Forward and backward bending after radiological healing.
- Range from 8 months to 2 years.

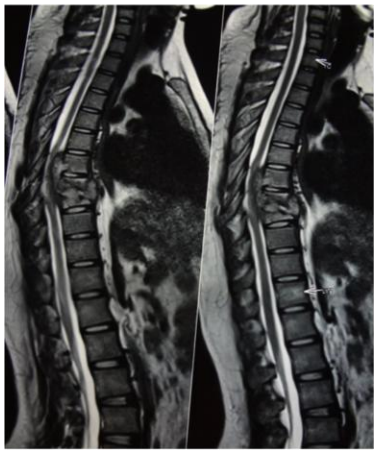
Post-op follow up :

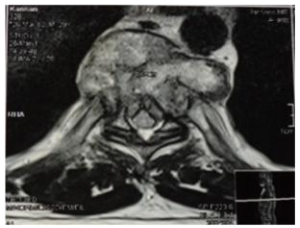
The patients are followed up at 3 months, 6 months, 1 year and every 6 months and evaluated for the Visual analogue pain scale and the functional outcome evaluated using Postoperative Frankel grading, Angle of kyphosis, Oswestry disability index.

Case 1

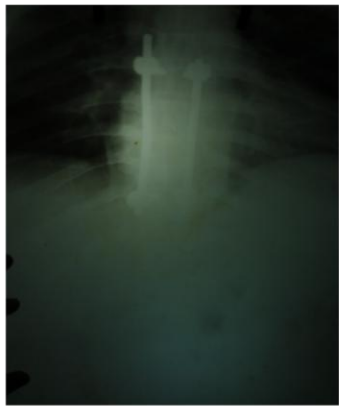
Pre op radiographs

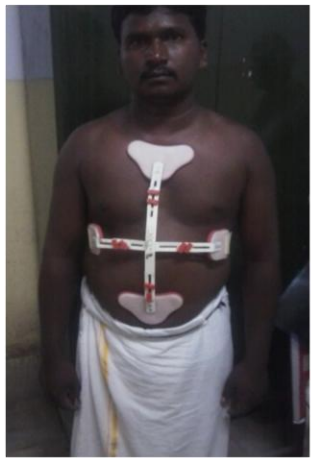






Post op radiographs

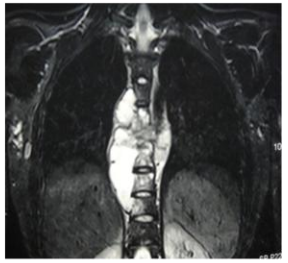
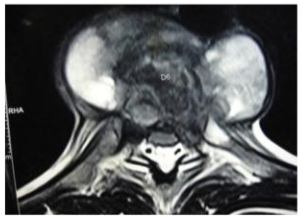



Case 2

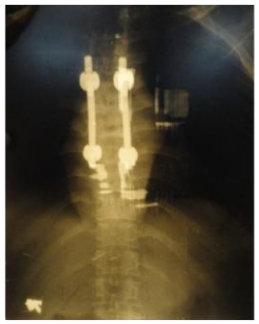
Preop radiographs



Post op Radiographs

Immediate post op



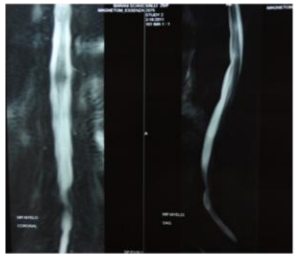

6 months Follow up

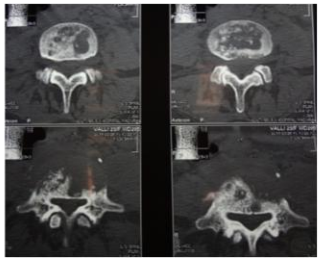


2 years Follow up

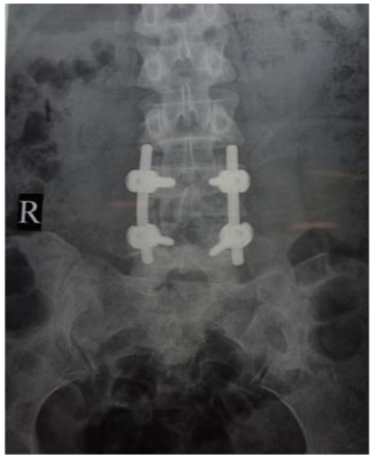

Case 3

Preop radiographs



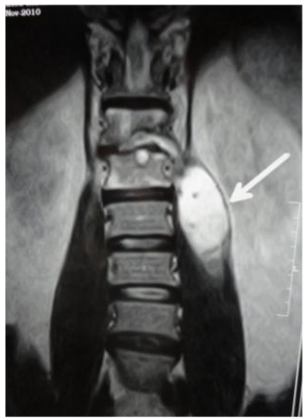


Postop radiographs

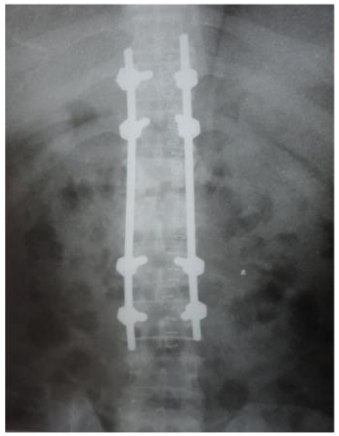


Case 4

Preop radiographs

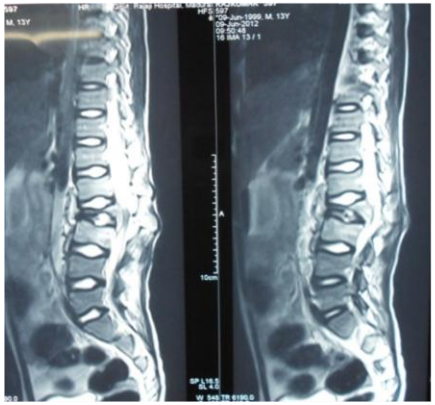


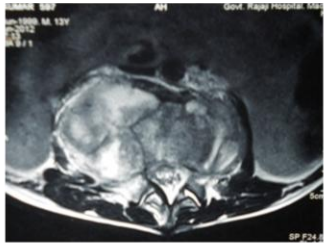
Postop radiographs



Case 5

Preop radiographs





Postop radiographs

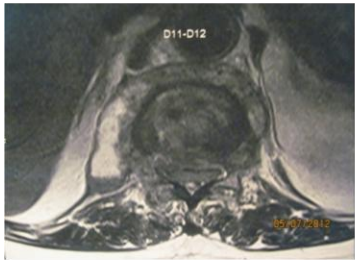
6 months follow up

Complications

1.Superficial wound infection

2.Implant failure

Preop radiographs



Postop radiographs

RESULTS

This study was conducted in our Hospital on 15 patients with Tuberculosis of Dorsal and Lumbar spine from July 2010 to June 2012. All patients were treated with posterior or posterolateral approach and stabilised with Pedicle screw system. The mean follow up period was 12 months (range 6-26 months).

The following observations are made in this study:

- There was equal distribution in male & female.
- The most common age group affected was 3rd and 4th decade (60%).
- The most common mode of presentation is pain (66.7%).
- The dorsolumbar junction is most commonly affected (46.7%).

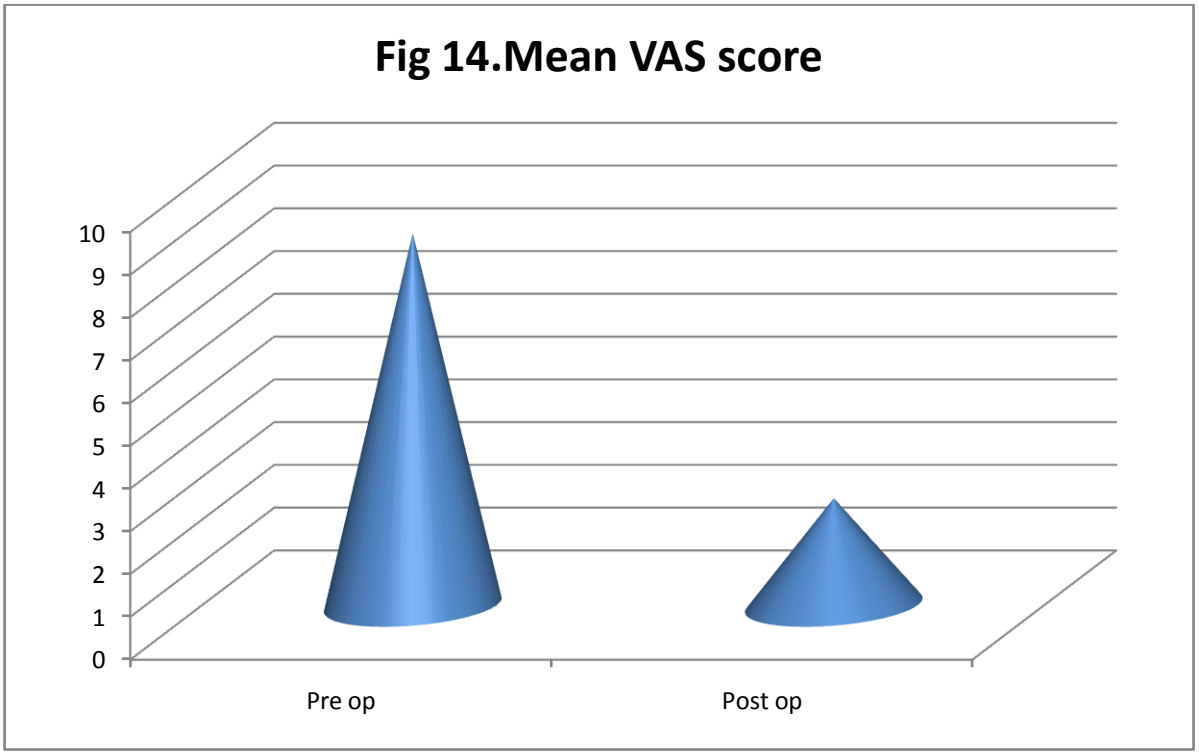
The following are the results of the study:

- The mean duration between surgery and onset of symptoms was 10.2 months (range 5-14 months).
- The mean surgical time was 3 hours 20 minutes (range 2h 20 min-4hr 10 min).
- The average blood loss was 800 ml (400 ml – 1500 ml).
- The mean preoperative Visual analog score was 8.7 (range7-10)which improved to 1.7(1-4) at final follow up implying better pain score postoperatively.
- The mean preoperative ESR value was 111.8 which improved to 31.7 at final follow up which indicates improvement in disease activity.
- Before surgery, 7 patients were classified as Frankel grade C,2 patients each with grade B,D and E& one patient with grade A.After surgery,all patients with grade C improved to one grade. Out of 2 patients with grade B,one improved to grade C and other improved to grade D.Of the patients with grade D, one improved to grade E and the other remained with grade D.One patient with grade A havenot recovered.

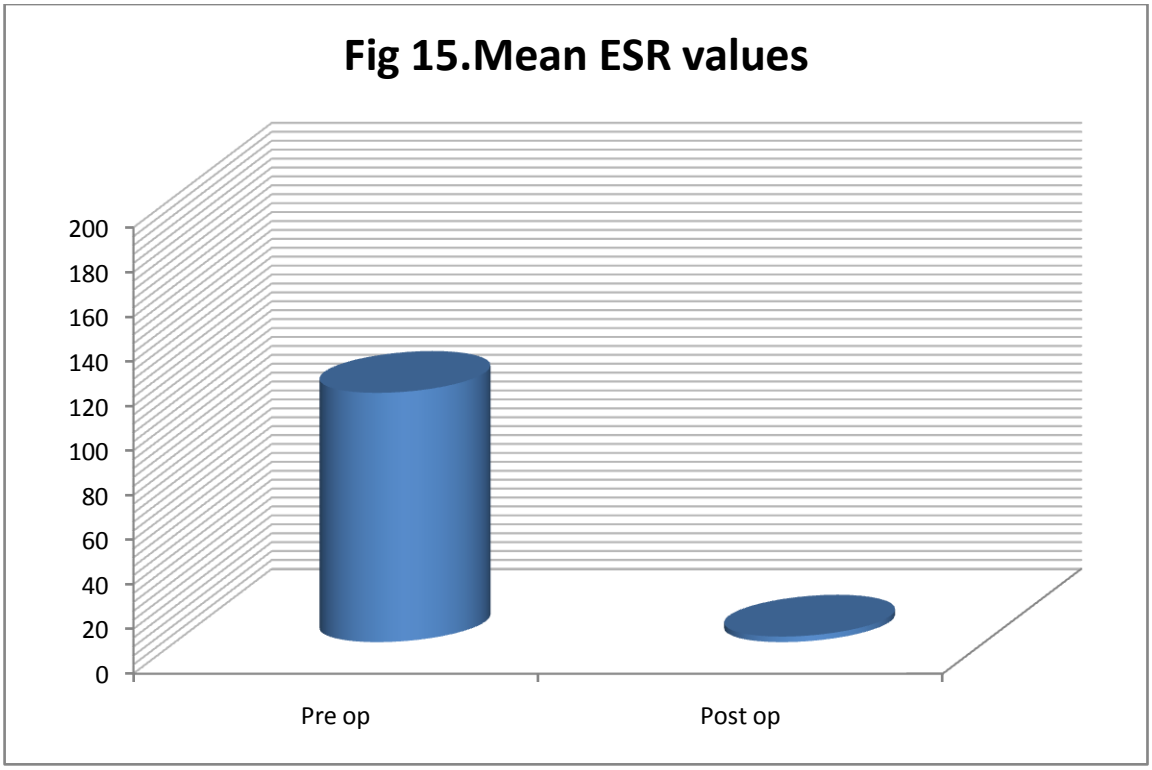
- The mean preoperative kyphosis in the thoracic and thoracolumbar spine was 27.9 degrees which was corrected to a mean of 9.5 degrees in the final follow up radiographs implying better correction and maintenance of kyphosis.

Complications:

- One patient developed superficial wound infection which healed by conservative methods and extended antibiotic therapy.
- Two of our patients developed implant failure. By the time they came for follow up, bony consolidation seen in the follow up X ray and hence implant exit done.

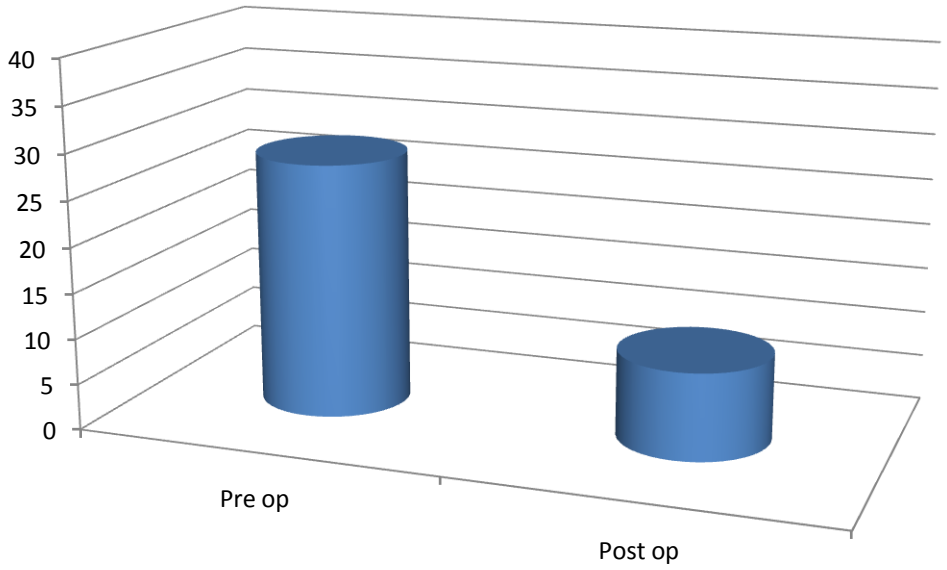


MEAN VAS SCORE	
Pre op	8.7
Post op	2.5



MEAN ESR VALUES	
Pre op	111.8
Post op	2.5

Fig 16.Mean Kyphotic angle (Dickson method)



MEAN KYPHOYIC ANGLE	
Pre op	27.9
Post op	9.5

DISCUSSION

The treatment of tuberculosis of spine consists of conservative methods or surgical management.

Conservative method comprises Bed rest with or without Plaster casts, Chemotherapy, Supervision with Imaging and blood markers every 3 months followed by resumption of activity with braces. It requires long period of immobilization and it leads to complications of prolonged recumbency like deep vein thrombosis, bed sore and chest infection. It cannot prevent the progression of kyphotic deformity.[1,18]

To circumvent the problems associated with conservative management and those who did not show signs of progressive recovery, development of neurological problems, neurological worsening during conservative therapy, advanced cases and in the elderly, surgery is indicated.

The goals of surgery in Tuberculosis of Thoracic and Lumbar spine are adequate decompression, adequate debridement, maintenance and

reinforcement of stability and correction and to stop the progression of Kyphosis.[22]

Among the various types of decompression, Anterior approach is considered the gold standard for debridement and decompression in Pott's spine. Anterior radical surgery was popularized by Hodgson and Stock in 1960.[3] Advantages of the traditional anterior approach are ability to directly access the disease and perform decompression, better correction of deformity, less muscle dissection and the ability to place a graft under compressive load for fusion.

The disadvantages of anterior approach are morbidity and mortality associated with the transpleural and retroperitoneal approach like atelectasis, chest infection, pneumothoax and postoperative ileus, increase in spinal instability after surgical decompression in the immediate postoperative period. Also when the patient has coexisting pulmonary pathology, the approach may be difficult.[23]

The structural bone graft in anterior approach does not give initial stability and graft related problems occur more often when the graft spans more than two-disc space. The tricortical iliac crest graft is associated with donar

site morbidity. The rib grafts are readily available after thoracotomy but they are structurally weak and doesnot contain cancellous bone.[12]

The stability of anterior instrumentation may not provide adequate fixation as there is concomitant inflammation associated with infection and the anterior bones are hyperemic and porotic. Implant holding is a problem and there might be risk of graft subsidence and graft slippage.

It was during 1970's that the modern spinal instrumentation was developed and came to use. There was an initial apprehension to use the metal implants in active infection. Oga et al.[24] studied the adherence capacity of Mycobacterium tuberculosis to stainless steel and concluded that adherence was negligible and the use of implants in regions with active tuberculosis infection may be safe and the tubercle bacilli, unlike pyogenic organisms do not adhere to metal and form any biofilm.

Posterior instrumentation with anterior decompression and fusion can be performed in one or two stages.[25] This surgery is more radical but recurrence rate is low. However, if performed in one stage, the procedure has more morbidity. When anterior decompression and bone grafting is performed as a first stage procedure, there is a risk of graft slippage and neural deterioration while waiting for second stage stabilization. In the second stage, only in situ

stabilization will be performed. When the posterior procedure is performed first, it will be only in situ stabilization followed by second-stage decompression, so kyphus correction will be minimal.

Guven and coworkers[26] after using posterior instrumentation in the form of pedicle screw or hook system for thoracolumbar tuberculosis of the spine have found clinical and radiological evidence of stable fusion in all their patients.

In this study, we used transpedicular screws with Moss Miami system because it has been proven to be a good method for stabilizing the thoracolumbar and lumbar spine. It is not radical as that of the anterior approach.

During instrumentation of the pedicle screws in thoracic and the lumbar spine, we inserted the screws into the healthy pedicles adjacent to the areas of bone destruction. There is a quick relief of instability[27] in patients treated with early stage spinal tuberculosis with transpedicular instrumentation.

This posterior approach has a special advantage in that it avoids contact with the infectious focus, because the tuberculous infection usually involves the anterior column. The fact that tuberculous lesions may heal in spontaneous fusion makes this posterior approach feasible.

The transpedicular instrumentation helps in maintaining the spinal alignment and stabilization of the involved vertebra. The posterior instrumentation acts as a spacer and allows the healing of the anterior mass and supports the anterior column.[28]

Posterior instrumentation has been reported to be quite effective in preventing graft related complications and progression of kyphosis. The main advantage of posterior instrumentation is that it can provide good fixation through posterior elements as the disease pathology is anterior. Posterior fixation also helps in correcting pre-existing kyphosis effectively.

Posterior approach utilizing only extra pleural approach, as described by Jain et al.,[2] is an effective option. Extra pleural approach allows decompression of spinal cord under direct vision and supplemented with a stable posterior instrumentation, which has the multilevel flexibility to be extended above and below if needed.

The cord was decompressed by excising a pedicle in order to allow access to the anterior debris. A limited debridement was undertaken to decompress the cord without creating a large defect. The exposure for the decompression may be improved by sacrificing a spinal nerve root at the level of the excised pedicle in the thoracic spine. This does not significantly affect

the morbidity because of the overlap of the dermatomes and circumvents the problems related to a thoracotomy.

The transpedicular route for decompression is preferable to the transthoracic procedure since it allows an adequate global removal of the anterior, lateral and posterior cuff of tissue, posterior stabilisation is possible through the same approach and chest complications related to thoracotomy in these patients are avoided.

The posterior instrumentation allows early mobilisation, thus avoiding the complications of prolonged recumbency. The stability provided by posterior fixation, particularly transpedicular fixation, protects the vertebral correction, and patients are able to return to normal activities within a short period of time .[29]

Poor sagittal spinal correction has been documented following anterior approach alone. While anterior instrumentation may prevent progression of kyphosis during treatment, it is not so effective in correcting pre-existing kyphosis. Addition of posterior instrumentation has shown to improve correction of sagittal alignment. Reported kyphosis correction ranges from initial 30°–35° to 15°–18° postoperatively, with 2°–3° loss of correction with an average followup of 45 months.[2]

In our case series also, the kyphosis correction was significantly better with posterior approach alone.

Bhavuk Garg et al. in a retrospective analysis of 70 patients with thoracic and lumbar tuberculosis compared the clinical,radiological and functional outcome of anterior versus posterior debridement and stabilization concluded that though the anterior approach is an equally good method for debridement and stabilization,kyphus correction is better with posterior instrumentation and the posterior approach is associated with less morbidity and complications.

GD Sunderraj et al.[27] in a prospective study of patients with tuberculosis of dorsal,dorsolumbar and lumbar spine combined with anterior or posterior instrumentation surgery concluded that adjuvant posterior stabilization allows early mobilization and rehabilitation.Graft related problems were fewer and the progression and the maintenance of correction of the kyphosis were better than with anterior surgery alone.Even when large amount of pus present there is no implant related risk.

Moon et al.[7] retrospectively analysed 124 patients with spinal tuberculosis in children and concluded that posterior instrumented stabilization alone could correct and prevent progress of kyphosis.

Lee et al.[8] in a retrospective case series using single stage Transpedicular decompression and posterior instrumentation of thoracic and thoracolumbar tuberculosis concluded that it can be an alternative treatment method of less involved spinal tuberculosis especially for patients in early phase of bone destruction or ones with mild kyphosis.

We prefer a posterior approach because familiarity of the approach and the complication rate is low.The benefits of our approach are early ambulation, decreased morbidity, and good access to dural abscesses, sequestrated bone and small abscesses in the anterior spine.

Posterior instrumentation can be used to correct deformity and any concurrent spinal stenosis in elderly patients can be treated simultaneously.

The results of our study show that thoracic and lumbar tuberculous spondylitis can be successfully treated through the posterior approach by meticulous debridement of necrotic bone and the infected disc. It allows easy access to the spinal canal for neural decompression, prevents loss of correction of vertebral alignment, and facilitates early mobilisation.

CONCLUSION

- The posterior/posterolateral approach (extracavitory approach) gives a reasonable access to the lateral and anterior aspects of the cord for an equally good decompression of the cord.
- It is a less morbid approach and avoids problems associated with thoracotomy and laprotomy.
- It facilitates early mobilization and avoids problems of prolonged recumbency.
- It provides better functional outcome and significantly better sagittal plane and kyphosis correction.
- Posterior approach preferred because of its familiarity, its simplicity, and its low complication rate.

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PROFORMA

Name of the Patient :

Age / Sex :

Occupation :

Past H/o :

Complaint/ Duration :

Pre-operative:

(a)ESR :

(b)Mantoux test :

(c)TC,DC :

(d) Visual Analogue pain scale value :

(e) Neurological status (Frankel grading) :

(f) Preoperative Oswestry disability index :

(g) RADIOLOGICAL

Xray-AP & Lat view

-Preopretive kyphosis(Dickson method) :

CT scan :

MRI :

Post-operative (Evaluation at 6 months, 1 year, every 6 months)

(a)ESR :

(b)Mantoux test :

(c)TC,DC :

(d) Visual Analogue pain scale value :

(e) Neurological status (Frankel grading) :

(f) Postoperative Oswestry disability index :

(g) Postopretive kyphosis(Dickson method) :

(h) Complications :

Table 1:

:

Site of involvement (Dorsal/ Dorsolumbar/ Lumbar)	
Age 10-20 21-30 31-40 41-50 51-60 61-70	
No. of Vertebra involved	

Table 2:

	ESR	TC	DC	Angle of kyphosis (Dickson method)	Visual Analogue Score	Neurological Status (Frankel Grading)	Oswestry Disability Index Score
Preoperative							
Postoperative							

OSWESTRY DISABILITY INDEX

Section 1 – Pain Intensity

_ I have no pain at the moment.
_ The pain is very mild at the moment.
_ The pain is moderate at the moment.
_ The pain is fairly severe at the moment.
_ The pain is very severe at the moment.
_ The pain is the worst imaginable at the moment.

Section 2 – Personal Care (washing, dressing, etc.)

_ I can look after myself normally but it is very painful.
_ I can look after myself normally but it is very painful.
_ It is painful to look after myself and I am slow and careful.
_ I need some help but manage most of my personal care.
_ I need help every day in most aspects of my personal care.

_ I need help every day in most aspects of self-care.
_ I do not get dressed, wash with difficulty, and stay in bed.

Section 3 - Lifting
_ I can lift heavy weights without extra pain.
_ I can lift heavy weights but it gives extra pain.
_ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned (i.e. on a table).
_ Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
_ I can lift only very light weights.
_ I cannot lift or carry anything at all.

Section 4 – Walking
_ Pain does not prevent me walking any distance.
_ Pain prevents me walking more than 1mile.
_ Pain prevents me walking more than ¼ of a mile.
_ Pain prevents me walking more than 100 yards.
_ I can only walk using a stick or crutches.
_ I am in bed most of the time and have to crawl to the toilet.

Section 5 – Sitting
_ I can sit in any chair as long as I like.
_ I can sit in my favorite chair as long as I like.
_ Pain prevents me from sitting for more than 1 hour.
_ Pain prevents me from sitting for more than ½ hour.
_ Pain prevents me from sitting for more than 10 minutes.
_ Pain prevents me from sitting at all.

Section 6 – Standing
_ I can stand as long as I want without extra pain.
_ I can stand as long as I want but it gives me extra pain.
_ Pain prevents me from standing more than 1 hour.
_ Pain prevents me from standing for more than ½ an hour.
_ Pain prevents me from standing for more than 10 minutes.
_ Pain prevents me from standing at all.

Section 7 – Sleeping
_ My sleep is never disturbed by pain.
_ My sleep is occasionally disturbed by pain.
_ Because of pain, I have less than 6 hours sleep.

_ Because of pain, I have less than 4 hours sleep.
_ Because of pain, I have less than 2 hours sleep.
_ Pain prevents me from sleeping at all.

Section 8 – Sex life (if applicable)

_ My sex life is normal and causes no extra pain.
_ My sex life is normal but causes some extra pain.
_ My sex life is nearly normal but is very painful.
_ My sex life is severely restricted by pain.
_ My sex life is nearly absent because of pain.
_ Pain prevents any sex life at all.

Section 9 – Social Life

_ My social life is normal and cause me no extra pain.
_ My social life is normal but increases the degree of pain.
_ Pain has no significant effect on my social life apart from limitingmy more energetic interests, i.e. sports.
_ Pain has restricted my social life and I do not go out as often.
_ Pain has restricted social life to my home.
_ I have no social life because of pain.

Section 10 – Traveling

_ I can travel anywhere without pain.
_ I can travel anywhere but it gives extra pain.
_ Pain is bad but I manage journeys of over two hours.
_ Pain restricts me to short necessary journeys under 30 minutes.
_ Pain prevents me from traveling except to receive treatment.

_ No
_ Yes (if yes, please state the type of treatment you have received.

Section 11 - Previous Treatment

Over the past three months have you received treatment, tablets or medicines of any kind for your back or leg pain? Please check the appropriate box.

SCORE INTERPRETATION OF THE OSWESTRY LBP DISABILITY QUESTIONNAIRE	
0-20% Minimal disability	Can cope with most ADLs. Usually no treatment is needed, apart from advice on lifting, sitting, posture, physical fitness, and diet. In this group, some patients have particular difficulty with sitting and this may be important if their occupation is sedentary (typist, driver, etc.)
20-40% Moderate disability	This group experiences more pain and problems with sitting, lifting, and standing. Travel and social life are more difficult and they may well be off work. Personal care, sexual activity, and sleeping are not grossly affected, and the back condition can usually be managed by conservative means.
40-60% Severe disability	Pain remains the main problem in this group of patients, but travel, personal care, social life, sexual activity, and sleep are also affected. These patients require detailed investigation.
60-80% Crippled	Back pain impinges on all aspects of these patients' lives both at home and at work. Positive intervention is required.
80-100%	These patients are either bed-bound or exaggerating their symptoms. This can be evaluated by careful observation of the patient during the medical examination.
Data compiled from Fairbanks et al, 1980.	

M.10.9.12

Ref. No. 5336 /E4/3/2012 Govt. Rajaji Hospital,
Madurai.20. Dated: .09.2012

Institutional Review Board / Independent Ethics Committee.
Dr. N. Mohan, M.S., F.I.C.S., F.A.I.S.,
Dean, Madurai Medical College & 2521021 (Secy)
Govt Rajaji Hospital, Madurai 625020.
Convenor
grhethicssecy @gmail.com.

Sub: Establishment-Govt. Rajaji Hospital, aMadurai-20
Ethics committee-Meeting Agenda-communicated-regarding.

The Ethics Committee meeting of the Govt. Rajaji Hospital, Madurai was held at 12.00 Am to 1.30.Pm on 26.07.2012 at the Dean Chamber, Govt. Rajaji Hospital, Madurai. The following members of the committee have been attended the meeting.

1. Dr.N.Vijayasankaran,M.ch(Uro.) 094-430-58793 0452-2584397	Sr.Consultant Urologist Madurai Kidney Centre, Sivagangai Road,Madurai	Chairman
2. Dr.P.K. Muthu Kumarasamy, M.D., 9843050911	Professor & H.O.D of Medical Oncology(Retired)	Member Secretary
3. Dr.T.Meena,MD 094-437-74875	Professor of Physiology, Madurai Medical College	Member
4. Dr. S. Thamilarasi, M.D (Pharmacol)	Professor of pharmacology	
5.Dr.Moses K.Daniel MD(Gen.Medicine) 098-421-56066	Professor of Medicine Madurai Medical College	Member
6.Dr.M.Gobinath,MS(Gen.Surgery)	Professor of Surgery Madurai Medical College	Member
7.Dr.S. Dilshadh, MD(O&G) 9894053516	Professor of OP&Gyn Madurai Medical College	Member
8.Dr.S.Vadivel Murugan., M.D. 097-871-50040	Professor of Medicine Madurai Medical College	Member
9.Sluri.M.Sridher,B.sc.B.L. 099-949-07400	Advocate, 2, Deputy collectors colony 4th street KK Nagar, Madurai-20.	Member
10.Sluri.O.B.D.Bharat,B.sc., 094-437-14162	Businessman Plot No.588, K.K.Nagar,Madurai.20.	Member
11.Shri. S.sivakumar,M.A(Social) Mphil 093-444-84990	Sociologist, Plot No.51 F.F. K.K. Nagar, Madurai.	Member

Following Projects were approved by the committee

MADURAI MEDICAL COLLEGE

Prof. Dr.P.V. PUGALENTHI
M.S. Ortho., D.Ortho.,
PROFESSOR & H.O.D,
Dept. of Orthopaedic Surgery,
Traumatology, & Rehabilitation

Dep ortho

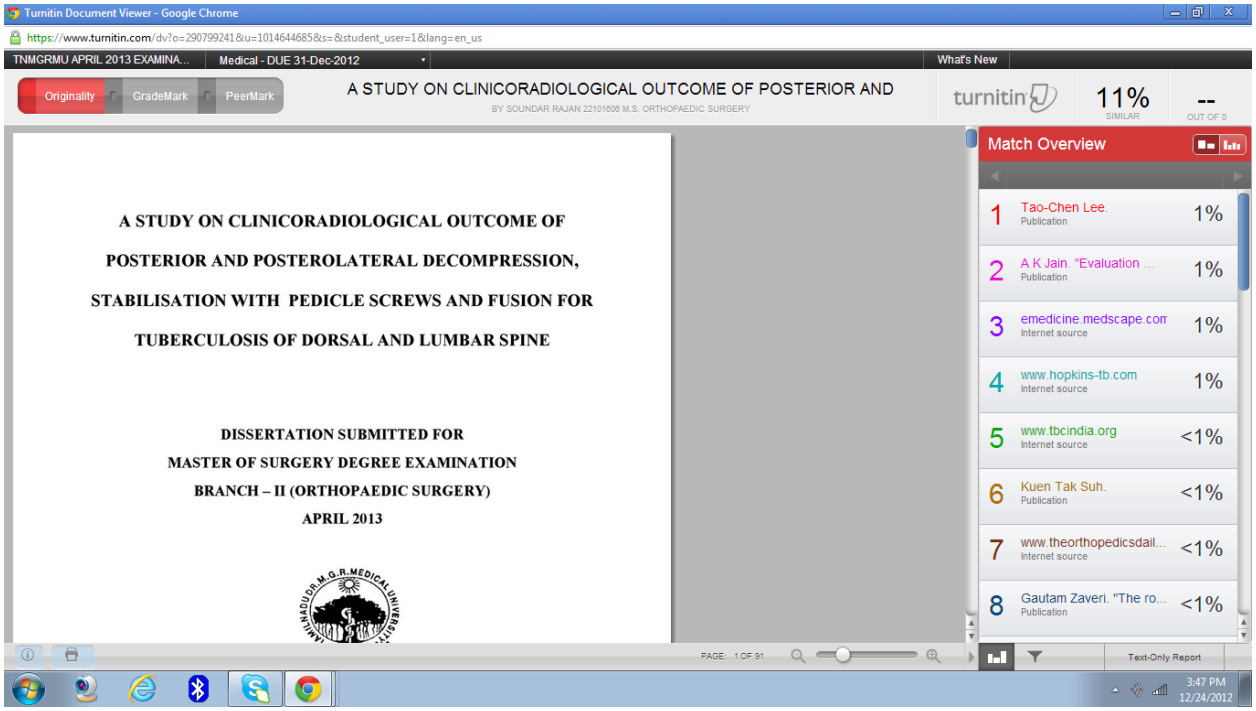
Sl. No	Name of P.G.	Course	Name of the Project	Remarks
1.	Dr. Soundarrajan. D	M.S Ortho	Posterior and poster lateral decompression stabilization with pedicle screws and fusion for tuberculosis of dorsal/lumbar spine.	Approved

Please note that the investigator should adhere the following: She/He should get a detailed informed consent from the patients/participants and maintain Confidentially.

1. She/He should carry out the work without detrimental to regular activities as well as without extra expenditure to the institution to Government.
2. She/He should inform the institution Ethical Committee in case of any change of study procedure site and investigation or guide.
3. She/He should not deviate for the area of the work for which applied for Ethical clearance.
She/He should inform the IEC immediately, in case of any adverse events pr Serious adverse reactions.
4. She/he should abide to the rules and regulations of the institution.
5. She/He should complete the work within the specific period and apply for if any Extension of time is required She should apply for permission again and do the work.
6. She/He should submit the summary of the work to the Ethical Committee on Completion of the work.
7. She/He should not claim any funds from the institution while doing the word or on completion.
8.She/He should understand that the members of IEC have the right to monitor the work with prior intimation.

8/9/12
DEAN

To
All the above members and Head of the Departments concerned.
All the Applicants.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MASTER CHART

Sl. No	Age/ Sex	IP No.	Site of involvement	Preoperative					Post operative					Complications
				VAS score	Frankel grade	ESR (mm/ hr)	Kyphosis (Angle of Dickson)	ODI	VAS score	Frankel grade	ESR	Kyphosis (Angle of Dickson)	ODI	
1.	55/M	062005	D10,D11	9	B	110	45	crippled	3	C	60	12	Severe	Screw pullout
2.	19/F	062869	D6,D7	7	D	90	34	Minimal	1	E	25	20	Minimal	Nil
3.	29/M	063905	D8,D9	9	B	92	42	Minimal	2	D	20	8	Minimal	Superficial infection
4.	25/F	054221	L4,L5	9	C	130	-11	Moderate	2	D	45	-20	Minimal	Nil
5.	42/M	016214	D12,L1	8	C	95	25	Moderate	1	D	10	3	Minimal	Nil
6.	32/M	055209	D10,D11	9	C	150	30	Severe	1	D	45	8	Minimal	Nil
7.	45/F	051206	L3,L4	9	D	120	3	Minimal	2	D	35	-20	Minimal	Nil
8.	39/M	072117	D11,D12	9	C	95	36	Minimal	2	D	10	15	Minimal	Nil

9.	36/M	074613	D12,L1	10	C	105	20	Severe	2	D	36	18	Moderate	Nil
10.	24/F	074992	D11,D12	9	C	170	22	Moderate	1	D	45	12	Minimal	Nil
11.	64/F	080010	D11,D12	9	A	180	40	Crippled	4	A	55	32	Crippled	Screw pullout
12.	35/M	082446	L1,L2	9	E	80	22	Minimal	2	E	15	5	Minimal	Nil
13.	39/F	079216	D9,D10	9	D	120	38	Moderate	1	E	25	22	Minimal	Nil
14.	24/F	081302	D11,D12	9	C	90	44	Moderate	1	D	35	20	Minimal	Nil
15.	13/M	042813	L2,L3	7	E	50	29	Minimal	1	E	15	18	Minimal	Nil

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